SCIENCE.

FRIDAY, NOVEMBER 27, 1885.

COMMENT AND CRITICISM.

THE RECENT COMPLETION of the new crematory at Mount Olivet, near Brooklyn, has again revived the subject of 'cremation *versus* inhumation.' An article by Dr. Rohé of Baltimore, recently published, takes the ground that there is no necessity of any radical change in our method of burial. While we are inclined to agree with him in his conclusions, we must take exception to a number of his statements. He says that, although the impression is general that cemeteries have an unfavorable influence upon the health of those living in the vicinity, there is very little trustworthy evidence to that effect. There is, we think, abundant evidence that in times past great injury to health has been caused by the burying of the dead in great numbers within city walls. Within recent times, when cemeteries are, as a rule, removed from the abodes of men, and are maintained in a far more sanitary way than formerly, these injuries have been reduced to a minimum. The history of New York City gives us proof of this. What is now Washington Square was seventy years ago the potter's field: from it arose most sickening odors at times. Troops stationed near it were seized with diarrhoea and fever, from which they did not recover until removed to another place. Trinity church cemetery was always regarded by the late Dr. Elisha Harris as contributing to the spread of cholera during epidemics of that disease in New York. He says, "Trinity churchyard, New York, has been the centre of a very fatal prevalence of cholera whenever the disease has occurred as an epidemic near or within a quarter of a mile of it." Other instances, almost without number, might be quoted as tending to show the prejudicial effect which some cemeteries have had upon the public health.

Dr. Rohé further states that "the generally observed good health of workmen in cemeteries and knackeries contradicts the opinion that the gaseous emanations from decaying animal matter are necessarily dangerous to health." This argument is one which needs great caution in its handling. It is one which is applied to every pursuit in life when for any reason that pursuit is charged with being detrimental to health. Thus scavengers, factory hands, and even children brought up on swill-milk, are, by those whose interest it is to make the claim, always represented as being in typical health. Statistics are appealed to oftentimes to bear evidence to the fact that the mortality in such a business is very small, when, as a matter of fact, the occupation of the decedent is stated as 'clerk' or 'laborer,' and the particular line of his occupation does not appear. Dr. Wicker, in his 'Sepulture and its methods,' calls attention to the depreciation in health of those who spend much time in the dissecting-room, suffering also from derangements of the digestive organs and diarrhoea. He has also found that those engaged about knackeries suffer similarly. "They begin to emaciate and present a cadaverous appearance, slight wounds fester and become difficult to heal, and, upon the whole, they are a short-lived class." That there is some danger to be apprehended from the fouling of water in wells situated near cemeteries, is shown by the fact that sanitary authorities find it necessary to limit the distance within which wells may be dug. Dr. Rauch believed that the water-supply of Chicago was at one time affected by the proximity of an old cemetery to its source. This question, like all others, has two sides; and while there is at the present time no urgent reason why earth-burial should be abandoned, in this country at least, there are many reasons why cremation should not be discouraged. The sentiment in its favor is certainly growing, and many of its promoters are among the best thinkers of our day. We certainly believe that those who prefer incineration to inhumation should have every opportunity to gratify their wishes, and, if necessary, that they should be protected by legal enactment.

IN VOLUME XIX. of the new edition of the 'Encyclopaedia Britannica,' published during the present year, in the article 'Polar regions,' by Clements R. Markham, p. 326, we find the following paragraph on the geographical work of the Greely arctic expedition: "Lieutenant Lockwood made a journey along the north coast of Greenland, and reached

a small island in 83° 24′ [N. Lat.] and 44° .05′ [W. Gr.]. Dr. Pavy and another went a short distance beyond the winter quarters of the Alert, and a trip was made into the interior of Grinnell Land. *But all this region had been explored and exhaustively examined by the English expedition in* 1875–76." The italics are our own. Attention has recently been called to this statement by the author, Charles Lanman, of a little memorial volume on the life and arctic work of Lieut. James B. Lockwood.

It appears certainly most astonishing that a writer on geographical subjects, especially those relating to the arctic regions, should allow haste, international feeling, or any other impulse, to lead him to make a statement in an authoritative publication which is not only untrue, but unjust in the highest degree to an explorer who died of privation in the very field of his labors. No explanation seems possible. It has long been a matter of record that Lockwood's farthest was not only the highest latitude reached by civilized man, but more than one hundred geographical miles in a direct line beyond Beaumont's farthest, and that the English expedition neither mapped nor 'explored and exhaustively examined' that part of the Greenland coast, nor the interior of Grinnell Land westward from Lady Franklin Bay and Archer fiord. It would seem a duty for the publishers, in another volume of the encyclopaedia, to place on record some disclaimer of this falsification of history.

THE AMERICAN ECONOMIC ASSOCIATION, which was recently organized at Saratoga, is represented as obtaining hearty support and co-operation, not only from professional students in political economy, but also from business men, who take a wide interest in the financial and industrial questions of the day. Among its members there are already professors representing more than a score of colleges and universities in all parts of the country, several college presidents, lawyers, editors of some of the most influential journals in the country, and a large number of clergymen, among whom may be named Dr. Barrows and Newman Smythe, not to mention Dr. Gladden and Lyman Abbot, who are actively engaged in the council of the association. Leading manufacturers are interested in its success, one of whom employs several thousand working-people, and another has more than a thousand names on his pay-rolls. The spirit of this broad and diversified support is well expressed in a letter from Dr. Elisha Mulford, the author of 'The nation,' in which he remarks that "in the transitions of human thought none has been more significant than the humanization of political economy." Committees are being organized for investigation on the co-operative plan. Under the leadership of Dr. Henry C. Adams, of the university at Ann Arbor, the committee on municipal finance is engaged in the special consideration of productive city property. It is collecting information concerning the relations of American municipalities to corporate institutions, such as railways, telephone lines, gas and water works, in order to determine the nature of the franchises which have been so freely bestowed by our cities. It will seek to learn, for instance, in what way rates of lighting-companies are controlled, and if any attempt is made to raise revenues from such institutions. This strikingly resembles the system of Le Play, and is thoroughly scientific in method. By such means an immense amount of economic data can be collected and synthesized in the light of economic science.

THOSE WHO ARE ANXIOUS to draw attention to themselves as claiming possible consideration from other scientific men too frequently have recourse to the use of all the titles which by accident or otherwise may have fallen to them. This tendency appears to have increased somewhat of late years, and, so far as this country is concerned, is doubtless an importation from Europe. It is, nevertheless, a tendency which should be deprecated. Aside from the very bad taste which it usually reveals, the indiscriminate use of all the titles which a man may possess, argues, in the first instance, a weakness which is thereby confessed to his scientific *confrères*. That titles have a definite value when properly used cannot be denied, and their attachment to a name on a business-card or in official correspondence is quite allowable; but even then, unless in exceptional cases, they should be reduced to the lowest terms consistent with the object in view. On the other hand, for one to go beyond his college and university degrees, and append the initials of all the scientific societies of which he may have become a member, savors of the methods adopted by the sciolist to gain cheap reputation. The modesty which usually characterizes true merit always shrinks from an undue display of the rewards which may have fallen to it.

DR. ASA GRAY'S SEVENTY-FIFTH BIRTHDAY.

THE seventy-fifth anniversary of the birth of Dr. Asa Gray occurred on the 18th of November. At the suggestion of the editors of the *Botanical gazette*, many of the botanists of North America united in presenting to the foremost botanist of the country a token of love and esteem in the form of a silver vase.

This vase was presented on the morning of the 18th, without formality. It is about eleven inches high, and is appropriately decorated with those plants which are distinctively American, and which are most closely associated with Dr. Gray. The place of honor on one side is held by Grayia polygaloides, and on the other by Shortia galacifolia. Among others, Aster Bigelovii, Solidago serotina, Lilium Grayi, Centaurea Americana, Notholaena Grayi, and Rudbeckia speciosa, are prominent. The workmanship is highly artistic, as well as remarkably accurate, and reflects credit upon the designers, Messrs. Bigelow, Kennard, & Co., of Boston.

The vase stands on a low ebony pedestal, which is surrounded by a silver hoop, bearing the inscription, —

1810 — November eighteenth — 1885.
ASA GRAY,
in token of the universal esteem
of American botanists.

The greetings, by card and letter, of the one hundred and eighty contributors, were presented on a plain but elegant silver tray. They contain the warmest expressions of esteem and gratitude.

In the afternoon Dr. and Mrs. Gray received, quite informally, many of their friends.

A NEW SYSTEM OF OYSTER-CULTURE.

THE hope that I might solve, or help to solve, the oyster-problem practically, has served to constantly encourage me for the five years that I have been working with that object in view. In the belief that what I now have to offer presents one of the only possible practical solutions of the oyster-question, I submit it to the oystermen of our country as a method by the help of which they may be enabled to rear an abundance of 'seed' upon areas which are positively and absolutely under individual, proprietary control. The first principles of the new method are given below, and it will be seen that they include or embrace all that it has been proposed to accomplish by the use of any other plans hitherto proposed; that is, it is proposed to utilize the three dimensions of a body of water, moved automatically back and forth in a canal by the tides, for the purpose of spat-collecting. In such a canal an enormous amount of cultch or collecting surface will be exposed to the fry, diffused throughout the three dimensions of the surrounding water, during the spawning season. In this way the maximum amount of spat can be obtained with a minimum expanse of water.

The first principles of the new method of spat or 'seed-culture,' which I here propose, are the following: —

1. Oyster embryos diffuse themselves throughout the three dimensions of a body of water, and will affix themselves to collecting surfaces similarly distributed, up to and even above low-water level.

2. The floating fry will adhere to smooth surfaces as well as rough ones.

3. The surfaces upon which spatting occurs must be kept as free as possible from sediment and organic growths, in order that the very tiny young

mollusks may not be smothered and killed during the most critical period of their lives.

4. Artificial fertilization of the eggs of the oyster is feasible, and will become an important adjunct to successful spat-culture.

5. The water charged with embryo oysters may be passed through a steam-pump without injury.

6. Oyster fry usually adheres most freely to the under surfaces of shells or other collectors, because the lower side is cleanest, and most favorable to the survival of the animals.

7. The spat of the oyster will grow and thrive with comparatively little light.

8. The specific gravity of the water may range from 1.003 to 1.0235.

9. The most favorable temperatures of the water for spatting seem to be from 68° to about 78° to 80° F.

10. Spatting will occur just as freely in ponds or tanks with a free circulation as in open water.

These are the elementary principles upon which we must base our new method. All have been verified by observation, and none of them are hypothetical; but to give an account of all the data upon which they are based would take up too much space here. The methods of spat-collecting used in Europe are too cumbersome and expensive; besides, they are inefficient when applied to the American oyster, largely because of its low price. The thing to do is to arrange the collectors in such a way as to expose an enormous area of surface to which the billions of fry, swimming about in the water, may become adherent. To effect this it is proposed to provide a pond, natural or artificial, and connect it by way of a long, zigzag canal with the open water. The area of the pond, for a good reason, should be about the same as that of the canal. The canal and pond should be of about the same depth, or contain about three and a half feet of water at low tide. No filters are needed, except, perhaps, a screen at the mouth of the canal to keep out starfishes, large crustacea, and predaceous gastropod mollusks.

The canal is provided with ledges near the top, at about the level of low-water mark, to support the receptacles for the cultch. These are formed of vertical wooden strips six inches wide, six feet long, and secured parallel to each other, and three feet apart, by a cross-piece at the top, and two horizontal side-pieces six inches wide, secured two feet six inches from the top of the vertical pieces. Coarse galvanized wire netting is then secured around the edges and lower ends of the vertical strips below the two parallel cross-pieces. This netting will then form, with the wooden frame, a basket three feet wide, three feet deep, and six inches thick. Such a basket will hold somewhat over three bushels of oyster-shells as cultch. The two cross-pieces which project beyond the vertical pieces will support the receptacle, with the shells which it contains. One of these receptacles is allowed to every running foot of canal, in which its position is vertical. The receptacles are therefore placed six inches apart. A pond forty feet square, and accommodating 100 bushels of spawning oysters, on two superimposed platforms, will supply enough fry for a canal 400 feet long, and holding 1,200 bushels of shells as cultch in 400 receptacles. The latter will cost, at the lowest rate for material and labor, $50 per hundred, or $200 for 400 feet of canal. One bushel of oysters will yield about one billion of eggs and fry. The pond, with its hundred bushels of spawning adults, will therefore yield about 100 billions of fry. This vast multitude of oyster-brood will be wafted back and forth through the collectors by the tides 360 times during the spatting season, which lasts for ninety days. That is, 100 billions of fry will be wafted through 1,200 bushels of shells 360 times during the season, thus insuring the fixation of the largest possible percentage of embryos. The shells can be kept clean by vibrating the receptacles on the ledges which support them. It will thus be seen that on one-tenth of an acre I can place as much cultch as could ordinarily be placed on four acres. Or, by my method, on one acre I can put down as many shells as could be put on forty acres by those who simply sow the shells; that is to say, the business of getting 'sets' for planting in the open water may be so condensed as to cover only one-fortieth of the ground now covered. After the lapse of ninety days, the cultch, with its adherent spat, is removed from the collectors, and sown in the open water. The method is therefore solely for the purpose of propagating the oyster, and commends itself as the most feasible in the Chesapeake region, where it is hoped that private enterprise will establish nurseries where seed-oysters alone will be cultivated, to supply the demand for planting new beds. Thousands of acres of the flat, marshy land skirting the Chesapeake and Chincoteage bays are available, and may now be converted into establishments for the culture of oyster-spat.

The plans set forth above are justified in detail by the facts observed by myself in the course of the experiments instituted by me during the last five years, under the auspices of the U. S. fish commission. In nature the theory is also abundantly verified, as, for example, at Wood's Holl, Cohasset, and Fortress Monroe. The fullest justification of the conclusions above presented is also given by the results obtained at Cherrystone in 1881, and at

St. Jerome's Creek from 1880 to 1885; while the most conclusive and irrefragable evidence is that obtained as the results of experiments instituted by Professor Brooks and Messrs. Blackford and Mather during the present year.

The maximum efficiency of the cultch is not realized in any of the old forms of collectors, for the reason that the cultch cannot be kept clean; second, because both sides of the cultch cannot be exposed to the passing fry; third, because the fry cannot be forced to pass over and amongst the cultch repeatedly; fourth, because the cultch has hitherto been scattered over too great an area, and throughout only two dimensions of a body of water, namely, its horizontal extent, whereas it is possible to do far more; that is, to avail ourselves of the possibility of obtaining spat throughout the three dimensions of a body of water charged with embryo oysters in the veliger condition. These are good and sufficient reasons for my assertion that cultch has hitherto been wastefully and unscientifically applied.

The new method outlined above will be explained in detail, with plans drawn to scale, in an extended illustrated article of mine now ready for publication by the U. S. fish commission. In fact, as a result of scientific inquiry, it has come about that there may be applied a more effectual means of diminishing the mortality and frightful waste of oyster embryos, which occur under the stress of those natural conditions which determine the 'struggle for existence.' This result was predicted at the close of a lecture delivered in 1883 by Professor Huxley, in these words: "I, for my part, believe that the only hope for the oyster-consumer lies first in oyster-culture, and, second, in discovering a means of breeding oysters under such conditions that the spat shall be safely deposited. And I have no doubt that when those who undertake the business are provided with a proper knowledge of the conditions under which they have to work, both these objects will be attained."

JOHN A. RYDER.

PASTEUR AND HYDROPHOBIA.

PASTEUR'S communication upon the treatment of hydrophobia by inoculation, to which reference was made in a recent number of *Science* (Nov. 6), is fully and authoritatively reported in the *Comptes rendus* of Oct. 26. His present results are based upon a series of experiments upon rabbits and dogs, extending over a period of three years. So numerous have been these experiments, and so uniform and certain their results, that he has no hesitation in applying these results to other animals, including man.

Pasteur finds, that if a rabbit be inoculated by trepanning the skull, and placing beneath the dura mater a bit of spinal cord from a dog which has died of rabies of the streets (*rage des rues*), the animal always develops hydrophobia after a period of incubation of about fifteen days. If from the spinal cord of this first rabbit a second be inoculated in a similar way, and from the second rabbit a third, and so on in regular series, it is found that the period of incubation becomes shorter and shorter, until, after the virus has thus passed through forty to fifty rabbits, the duration of incubation is reduced to seven days. The incubation has remained at this point for a series of ninety inoculations, and it shows no tendency further to decrease. The virus has now reached its highest degree of intensity, and it remains of a constant quality. It is possible, therefore, to have such a pure virus of rabies at all times at disposal.

If portions of the spinal cord of rabbits which have died of this intense rabies be cut out with every precaution to prevent contamination, and if these portions of cord be suspended in a dry atmosphere, the virulence of the poison progressively disappears until it is completely extinguished. The time required for the extinction of the virus varies somewhat with the thickness of the cord, but especially with the temperature. The lower the external temperature, the longer the virus lasts. To preserve the cords, Pasteur places them in flasks, in which the air is rendered dry by bits of potash in the bottom of the flasks. It is possible, therefore, to have the virus of rabies in all degrees of intensity.

In order to render a dog refractory to hydrophobia, it is necessary to inoculate him with a series of spinal cords from rabbits dead of rabies, beginning with cords containing the weakest virus, that is, the cords longest preserved, and ending with cords containing the most intense virus, that is, cords preserved only one or two days. The animals are inoculated every day with cords representing successively each day or each two days of preservation. The inoculation is effected by injecting beneath the skin a Pravaz syringeful of sterilized bouillon in which a fragment of the spinal cord has been rubbed up. In this way complete immunity to the disease is established; so that, after the treatment is finished, the animal can be inoculated either subcutaneously or beneath the dura mater, with the most intense rabid virus, and no symptoms of hydrophobia appear. Pasteur has fifty dogs, of all ages and of all races, which in this way, without a single failure, he has rendered refractory to hydrophobia. The treatment is effectual even if it be applied after the dog has been

bitten by a rabid animal. Experiments are now in progress to determine how long an interval may elapse before the treatment ceases to be effectual. This interval is at least a number of days.

In the case of the boy Joseph Meister, who was successfully treated by this method, Pasteur began the inoculation sixty hours after the reception of severe bites by a rabid dog. The first inoculation was with a portion of spinal cord which had been preserved fifteen days. The treatment lasted for ten days; in all, thirteen inoculations were made, each one with a cord one day fresher than that used in the preceding inoculation; at the last inoculation there was used a cord preserved only one day, and containing a virus which produced rabies in a rabbit in seven days; that is, a virus more malignant than that in the bite of a dog affected with the rabies of the streets. The boy was kept under observation, and at the time of Pasteur's communication — three months and three weeks after the bite — no symptoms had developed.

After Pasteur's communication, Vulpian advised that a service be organized for the treatment of rabies by Pasteur's method.

Pasteur is unable to explain in what way immunity is produced by his method of inoculation. He thinks that the virus is altered in quantity rather than in quality by his method of preserving the cords. He notes the interesting fact, that, if the cords are preserved in a moist atmosphere of carbonic acid, with oxygen excluded, the original virulence remains unchanged, even after several months.

The full details of Pasteur's experiments upon animals, with description of symptoms and of *post-mortem* examinations, will be awaited with great interest. It is a matter of regret that we are not informed as to the nature of the virus, which, indeed, does not seem to have been discovered. It is probable that Pasteur's studies in this direction will lead to fruitful results.

A large number of observations are necessary in order to establish the efficacy of Pasteur's treatment of hydrophobia in human beings. His results certainly warrant a belief that, if the treatment be begun soon after the reception of the poison, this otherwise most hopeless and dreadful disease can be prevented. Should this belief become a proven fact, then Pasteur will merit the gratitude of all mankind.

THE PLAINS OF BRITISH AMERICA.

Striking contrasts present themselves to the experienced eye between the plains of British America, through which the lately finished Canadian Pacific railway has laid its tracks, and those crossed by any of the transcontinental lines in the United States. In the first place, they are larger. It is more than 1,000 miles from where the forested granites of Keewaydin dip under the Silurian prairie-floor in the Red River valley to the first escarpments of the Rocky Mountains. In Kansas it is hardly half as far between the wooded region and the foot-hills of Pike's Peak.

Another feature is the prairie-like look of it all, save certain far-western tracts. The grass is dense and long, flowering herbage is profuse. West of the South Saskatchewan this gives place to a greater, more 'plains' like scantiness of vegetation, to be sure, but nowhere is the bareness and aridity of the southern plains equalled.

This is due to the greater moisture in earth and air, and to the extraordinary fertility of the soil; Manitoba producing an average of 21½ to 22 bushels of wheat to the acre, or 4 to 5 bushels in excess of the average of any other similar space on the continent. The soil is coal-black, and declares its richness at first sight. Dr. Robert Bell, of the Canadian geological survey, discussed the causes of this fertility before the Canadian royal society, May 23, 1883. He pointed out that the materials were the best possible, having been derived from the glacial drift of the north, mingling sand and gravel with the cretaceous marls spread over all British America. Having this favorable constitution, Dr. Bell assigns to the moles the chief agency in the formation of the thick top-layer of vegetable mould which is now the joy of the farmer. In the Assiniboine valley the moles have thrown up almost every foot of the soil into hummocks, each containing a large shovelful of earth, and burying completely the grass and vegetation over a space a foot or more square. The vegetable matter thus buried decays, and becomes incorporated with the soil; so that the process is analogous to ploughing under the soil. This work of the moles not only enriches, but refines the soil. In making their burrows, they select the finer material and cast it up to the surface, leaving behind the coarser. The effect of this is similar to that alleged by Darwin of the earthworms (which do not exist in the north-west territories), since, in the course of time, all the stones are buried. Their labor is supplemented by that of the gophers, spermophiles, and badgers, the last named digging deeply, and heaving up large quantities of gravelly subsoil, which the moles work into and improve, while all bury much vegetable rubbish as nests and food. This beneficent animal agency nearly ceases, however, when the elevated hard and stony 'third steppe,' called the Grand Coteau du Missouri, is reached, and when the mountains are approached, where the soil is clayey.

About 100 species of trees and shrubs are recorded as growing on the north-western plains, while the list of herbaceous plants is a very long one. A good many noxious weeds have been introduced with civilization, and some flourish most aggressively. The worst pests are Canada thistles, wild mustard, oats and buckwheat. The Thlaspi arvensis, or mithridate mustard, commonly known as 'penny cress,' is a great nuisance in the Red River valley, where it sprouts and flowers in spring, surrounded by snowbanks, and exposed to severe frosts. Sunflowers rise abundantly wherever the soil has been disturbed, and ought to be utilized. Insect and fungoid pests to crops are remarkably scarce, though the Rocky Mountain locust has at times invaded the Red River valley.

The grasses are many, and those called 'buffalo-grass' attract the first attention. True buffalo-grass (Buchloe), however, is not found north of the boundary. The buffalo-grasses of that region are Butchelona oligostachia, representing the gramina grasses of the south-western United States; and Stipea spartea, more often called 'spear-grass,' or by several names indicating what Dr. Holmes calls its 'diabolish' characteristics. The young spring leaves of the Stipea spartea are the most succulent and nutritive of all the prairie-grasses, which, as a rule, are harsh and sedge-like; they are short, and form themselves into tussocks (most noticeably in dry uplands), which, though useless in making hay, provide a very valuable pasturage. It spreads over the entire north-west, and is most plentiful on the buffalo plains, where it stood as the staff of life to the vast herds of wild cattle once ranging those limitless opens.

The peculiarity which earns for it the evil names 'spear-grass,' 'wild oat,' etc., belongs to the fruit. The covering of the seed is about seven-eighths of an inch long, and terminates in an excessively hard, sharp, and obliquely curved point; the extreme tip is bare, but close behind are set stiff, fine, silky hairs, all pointing backwards and upwards. The seed is borne at the end of an awn, which is kinked and twisted in a peculiar way, so that when dampened it gradually straightens out with a corkscrew motion, the effect of which (whatever its 'design') is to force the spear of the seed forward and spirally into whatever it happens to be pressed against, while the barb-hairs aid the penetration and prevent easy withdrawal. Darwin's experiments with the awns of an allied but less formidable species (S. pennata) will be remembered; while the Proceedings of the Linnean society of London, 1884, contain an account of experiments with S. spartea itself, by R. Miller Christy.

The seeds ripen about the middle of July, and are at that time troublesome, as they have the power of penetrating the clothing and pricking the skin painfully. An insect-collector finds them a great nuisance, since they knit his net into hard knots in a short time. Woolly-haired dogs are tormented by them, and this grass has always been dreaded by sheep-owners and cattle-herders. Most of the stories told of it, nevertheless, are gross exaggerations, though it is true that they do get into wool badly, and sometimes penetrate the skin. On the extensive sheep-ranges at the foot of the mountain it is now customary, before stocking a certain range, to burn over one-half of it a year in advance, before the spear-grass has had time to ripen. The sheep are introduced to the new grass the next spring, and feed upon it while the remaining half of the range is burned. When that is ready, they are moved and the first half is reburned. By this means the spear-grass is said to be got rid of in two or three years, and will not return so long as the sheep remain.

Horses and cattle live upon this grass on the wild plains without harm. Prof. John Macoun of Ottawa told me that in seven years of plains travel his horses had never been harmed. The object of the mechanism of the awn apparently is to insure its planting by being pushed well into the ground; this accomplished, the awn soon rots off, and the seed germinates. Mr. Miller, in his Linnean society paper, points out how the buffalo paid for his pasturage by transporting the seeds of this best of grasses in his rough coat, extending its distribution by planting them wherever his mats of shedding wool fell off in the spring. Thus this beast constantly widened its feeding range, and provided for its increase in numbers. Of course, this grass was not the only plant thus carried by seeds north, south, east, and west, by the migrating herds; nor was the bison the only animal whose hairy coat would carry the clinging awns.

The buffaloes have abandoned all the region south of the Saskatchewan since 1878. Even their bones have been pretty thoroughly picked up. The little tributary of the Qu'Appelle River, upon which Regina, the capital of Assiniboia (province), is situated, is called Pile of Bones Creek, after a great heap of bones, chiefly bovine, which formerly lay upon its bank where the Crees had a favorite camp-ground. It would have been a 'bonanza' for the archeologist, doubtless; but an unscientific person shipped the whole heap away to Philadelphia and sold it, relics and all, at five dollars a ton. One sees all along the railway track now, just as used to be the case in Kansas and Nebraska, mounds of buffalo skeletons ready for shipment to fertilizer factories. At many

stations, particularly Moose Jaw (which owes its name to the shape of the bend in a creek there), you may buy excellent specimens of buffalo-horns, somewhat polished, and bound together with forehead-hides or bead-embroidered flannel, — the work of Indians and half-breeds.

ERNEST INGERSOLL.

NEWCOMB'S POLITICAL ECONOMY.

IN illustrating the ease with which labor may rush from one channel to another in case of a change in demand, Professor Newcomb remarks on p. 115 that "a professor of one science can commonly teach another." If he had said that it is unhappily true that an ignorant and unthinking public often considers that a man eminent in one department is equally so in several or all other departments, or that it is a common but most vicious notion that a college professor of one branch might just as well be professor of another also — as, for instance, that the professor of Christian evidences and New Testament Greek may also take physics as well as not, — and that this absurd notion is at present one of the most serious obstacles to any real improvement of our educational system, he would have been very much nearer the truth, and, we cannot help believing, nearer to his own real opinions when in his soberer moments. Certain it is, at any rate, that if a man who had given the best years of his life to the study of political economy should wander over into the field of astronomy and physics, and undertake "to bring order into the reigning confusion," and "to give the subject a recognized place among the sciences by being the first to treat and develop it as a science," Professor Newcomb would be just the man to administer a severe and deserved castigation. The offence is none the less serious, because in this case we have a great and successful astronomer and physicist wandering over into the economic field and undertaking to set things to rights.

The fact is that the progress of modern science in every branch has been so great within this century, that he is a bold man indeed who thinks that he is entitled to speak as an authority even in two or three fields, though they be very closely allied. The mere work of mastering the facts which are necessary to enable one to speak with confidence has become so great in almost any of the more developed branches of human science, that it is the task of years to do this for a single branch, to say nothing of a half dozen. It is, however, perfectly within the power of an able man to write a treatise on a science of whose present status he knows next to nothing, which shall present the subject as it was some time in the past, provided he goes back far enough toward the beginning of things. This is just what the author has done in this book. If he had published it fifty years ago it would have been a valuable contribution to the subject. Coming at this late day, it is still valuable as an instance of how completely a man may enter into the ideas and thoughts of a past generation, and how skilfully he may re-present them.

There is no evidence in the style of reasoning in this work that the author is at all acquainted with the recent literature of the science either in England or on the continent. One great advance in economic science of the last twenty-five years lies in a change of its prevailing method. It has been affected in a most healthy way by the enormous progress of physical and natural science. It is reaching out to avail itself of their methods so far as possible. As a result of this new method, it has come to reject the old generalizations, and, while recognizing that they were exceedingly valuable in their time, and formed important, nay, necessary links in the chain of scientific progress, it now insists that we have ample evidence of their crudeness and incompleteness, and that, taking whatever may be left of them that is true, we must now look for valuable results to careful and far-reaching inductive study of the facts of our social and economic organism as the indispensable basis of new and more fruitful generalizations.

Of all this there is scarcely a trace in Professor Newcomb's treatment. He repeats exploded theories and almost universally rejected laws with the utmost naïveté as "principles which will be accepted by all who understand the subject." It is true that he calls attention, in his chapter on economic method, to the necessity of more exact definition and careful reasoning; but taken in connection with his actual treatment, it has much the same effect on the professional economist that would be produced on the physicist or astronomer by an attempt on the part of Wilhelm Roscher or Cliffe Leslie to restate the corpuscular theory of light on the Ptolemaic system of astronomy with a greater exactness of definition, and closeness of reasoning. A work prepared in this latter spirit would doubtless have a value, as, for example, for disciplinary purposes in an old-fashioned college, but it would hardly be accepted by prevailing authorities as in any sense a productive contribution to the science.

Professor Newcomb's work is written from the old stand-point of extreme individualism. The author takes it for granted, and indeed expressly asserts in more places than one, that the individual, in fol-

Principles of political economy. By SIMON NEWCOMB, Ph.D., LL.D. New York, *Harper & Bros.*, 1886. 548 p.

lowing out his own interest as he views it, will at the same time always promote in the most efficient manner the public interest. In speaking of ownership in natural agents, he remarks (p. 81) that "under our actual system the care which every prudent person takes of his own property is extended by the owners of natural agents to their property, and thus the contents of the great storehouses of nature are protected from waste." Surely the author knows of the great devastation of our forest lands by private owners, bent on following their own interest to the exclusion of that of the public. He has surely heard of the revelations recently made in England and Ireland which showed that the productiveness of agricultural lands was permanently lowered by the policy of interference adopted by the landlords, and which led to most vigorous restrictions on freedom of contract in the interest of the community. Surely the author knows that in nearly every state in the union it has been necessary to pass laws for compulsory drainage of swamps, whose owners refused in some cases to have them drained at all, even at others' expense. These are illustrations of a law very different from that enunciated by the author, and that is, that the interest of the individual diverges at a thousand points from that of the whole, and that positive legislation is needed at all times to secure the interests of the latter as against the former. Professor Newcomb himself, indeed, almost immediately takes back the statement quoted above by admitting that we have to depend upon law and public opinion to control private interest; but as he repeats the former statement in many different forms, and founds his whole system of *laissez-faire* upon it, we must accept it as his real view.

As a fair specimen of the mode of reasoning, we may refer to the investigation begun on p. 513, as to whether "any system intended to limit the liberty of any man to acquire all the wealth he can by legal means, and to employ it in the way he chooses, can conduce to the general good." The question, as stated, involves a *petitio principii*. By *legal* means? What does this phrase 'legal' mean? It is evident that the author is thinking of the means which are legal under our present system of laws in this country. But he is trying to get formulas for a general political economy which shall hold good of present, past, and future societies alike, and our laws are not the same as they were a century ago, or as they will be a century to come; nor are they the same as English or French or German laws. Nobody denies a man's right to get all he can by legal means, but very many people deny that certain means now legal are judicious, and promotive of the public good. The author evidently goes upon the assumptions that our present laws are just and natural, and that any thing which is legal under them is also just and natural,—two assumptions which constitute the whole point in dispute. He sums up the discussion in the remark that "the fact is, that on our present system the enjoyment of the collected wealth of the community is as nearly in accord with the ideal principles of equity as any general system can be." This sounds like a voice from the dead. It is worthy of the worst period of 'Manchesterism.' It is this kind of political economy, which, regarding the case as closed in favor of the existing order in its present form, has done and is doing more to promote the most dangerous type of communistic and socialistic spirit and doctrine than all the vaporings of so-called professorial socialism of the last generation. Even John Stuart Mill declared that communism or socialism could not be any worse than the existing order, if this order is capable of no improvement.

If, passing over this fundamental view, which is, of course, the most important consideration in the case, we look at the details of the book, we shall find much to admire. The qualities which have made the author one of the most eminent astronomers of this generation serve him a good turn in his discussion of several of the most important topics. There is a general tone of fair-mindedness which is often lacking in works written from the general stand-point of the author, and which makes one only regret still more keenly the author's lack of special knowledge, which, if it had been supplied, might have given us a really valuable work. Some misstatements of facts should perhaps be noticed. The discussion of the national banking system was evidently written several years ago, and not revised to date. There is an unhappy confusion of the labor party with the socialists, which again reveals the author's ignorance of actual facts in the social organism of which he treats. In his discussion of bimetallism, he says that the government goes on the assumption that "the values of equal weights of the two precious metals have a certain fixed ratio," — a statement which is not true as a matter of fact, and is a gross caricature if intended to represent the views of bimetallists. E. J. JAMES.

TEXT-BOOK OF BOTANY.

NOTWITHSTANDING the rapid multiplication of text-books within recent years, it is a pleasure to

Gray's botanical text-book. Physiological botany, part ii. By G. L. GOODALE. Philadelphia, *Ivison, Blakeman, Taylor, & Co.*, 1885.

welcome this new work on botany as a most acceptable contribution to our resources for instruction. Part i., devoted to histology, has already been noticed (*Science*, vol. v. p. 157), and it only remains for us to direct attention to the larger part of the complete volume, part ii., devoted to physiology.

The present volume is especially welcome from the fact that it is the finest work of the kind published in this country. The nearest approach to it is the text-book by Dr. Bessey. Until now we have been obliged to depend upon reprints from the German for all text-books upon this very important department of botanical science; but it is to be hoped that the issue of the work before us is indicative of a permanent change in this direction, and that for the future we may have standard text-books capable of bringing the student into intimate acquaintance with the most recent acquisitions.

In its general make-up, the book is very creditable, and a decided improvement upon the usual appearance of text-books. The paper and letter-press are good; while the figures, of which the publishers have granted the author a fairly liberal allowance, are fresh, — an evident effort having been made to avoid stereotyped illustrations,—and in most cases admirably well executed. The references to the literature of the various subjects treated are quite full, and will be found a most valuable aid to the student, as also will the large amount of additional matter embodied in the footnotes. The student is also provided at the end of the volume with a large number of suggestions as to the apparatus and materials required in both histological and physiological studies. Also, as of special advantage to those wishing to follow an independent course of study, there are many valuable suggestions as to the subjects which may be most profitably considered. Valuable as such suggestions are, however, they can only serve as a basis; and the student must of necessity outline his own course to a very large extent, since he would otherwise find it physically impossible to accomplish all that might seem desirable.

The author has endeavored to leave no important physiological fact without discussion, while his entire treatment of the subject as a whole will commend itself to teachers generally as clear and logical, although in many instances there appears to be a lack in fulness of treatment which would be highly desirable, but which would hardly be practicable in the limits of a book designed for an ordinary course of instruction.

In some instances, however, this becomes a fault, since the abbreviations are sometimes carried to such an extent as to give the student an imperfect conception of the subject discussed. Such, however, are minor faults, and are almost inseparable from necessary curtailment of discussion. They all readily disappear under the guidance of a competent teacher, and the author is certainly to be congratulated upon having reduced errors of all kinds to a minimum. While giving the most recent views obtained, the author wisely errs on the side of prudence in not allowing himself to give too great weight to opinions which are not fully justified.

Our knowledge of both histology and physiology is now advancing at such a rapid rate, that many errors of omission, and possibly, in some cases, of fact also, are almost inseparable from a work of this kind. The time which elapses between the reception of the manuscript by the publisher and of the book by the public, is sufficient to make many statements old, and often to upset previous views. Bearing this in mind, the book is fully up to the times, and we can commend it as destined to meet in a most acceptable manner a long-felt want.

HORNADAY'S TRAVELS IN BORNEO.

ALL things considered, this is one of the most satisfactory books of its kind that we have seen for many a day. Its author possesses to a marked degree the happy but rare faculty of knowing just how much science the general reader likes to have mixed with his narrative, and also how to give it to him without missing either the science or the narrative. Mr. Hornaday's style is none of the best, but there is such a freshness, such a genuine ring, and such a realness to his narration, that one is willing to overlook his many deficiencies in the art of expression, his numerous inelegancies, and even his incessant use of slang words and phrases. In fact, the most serious objection we have to the book lies in another direction, and is something for which the publisher is more to blame than the author. We refer to its weight, — a little less than three pounds avoirdupois. Now, there is no objection to printing dictionaries and other works of reference in large, heavy tomes. Such books are designed merely for reference, and can be used when lying open on a table or book-rest. But when it comes to asking one's readers to sit solemnly down to a narrative of sport and adventure as to a Webster's unabridged or a consular report, it is asking too much.

Mr. Hornaday's journey to the jungle — which simply means woods — was undertaken for the purpose of procuring specimens for Mr. Ward's

Two years in the jungle. By WILLIAM T. HORNADAY. New York, *Charles Scribner's sons*, 1885.

well-known establishment at Rochester. From a commercial point of view, the venture must have been very successful, although our author was compelled, while in Ceylon, to bottle his snakes and fishes in methylated spirits, upon which the Ceylon authorities had collected a duty of four hundred per cent. He protested in vain, for the money had been paid by his bankers before his arrival on the scene, and the customs authorities refused to refund, even when he offered "to take the unlucky case of spirits through the custom-house, and bury it in a quiet corner of the back-yard, where it would not smell bad." The officers only replied, 'Couldn't do it, couldn't do it.' 'They had those rupees,' our author declares, 'and meant to keep them.'

Naturally, in the course of two years in the jungles of Ceylon, India, Selangore, and Borneo, one has many hair-breadth escapes. But the adventure, which he asserts was "ten times more dangerous than any I experienced with the head-hunters of Borneo," was experienced much nearer home. It was while engaged in skeletonizing some jackasses in the Emerald Isle that he was set upon by 'a mob of wild Irishmen,' who assailed him with long-handled hoes, on the ground that the donkeys had been murdered. He was finally allowed to depart by stealth, after having been boycotted for a few days, with his own bones intact, but without his asinine skeletons. These quotations will serve to show not merely the author's unhappy lack of skill in expression, but also the pleasant and truly American way he had of looking on mishaps which would have driven the average British sportsman to the *Times* or an insane-asylum.

One of the quaint features of the work, and one which we should have been very sorry to miss, is the way in which he loses the sportsman and narrator in the collector, and naïvely tells us where this or that stuffed effigy can be found. Thus, after describing an elephant hunt, and the subsequent skinning at a time when the elephant was several days older than when he died, he adds, "The old tusker, who fell under such romantic circumstances on the Animallai slope, now stands, still 'the monarch of all he surveys,' in the Museum of comparative zoölogy of Harvard university, Cambridge, Mass.

The whole volume is entertaining, though the most interesting portion, perhaps, is that wherein Borneo, with its head-hunting Dyaks, its tree-jumping gibbons, and its unpleasantly human orang-outangs, is described. Without disparaging the work of Wallace, Bock, and others, this is the best description of Borneo, so far as it goes, to be found in the books. Our author views the Dyak in the innermost recesses of his house, and tells us how he eats, drinks, sleeps, dresses, and earns his living. It is worth noting that Mr. Hornaday takes issue with Wallace as to the maximum height of the orang-outang, which Wallace gives as four feet and two inches. Our author and his hunters killed or captured forty-three, no less than seven of which measured more than four feet two inches; one, a Simia Wurmbii, measuring, when fresh, four feet and a half from the top of his head to the sole of his foot.

We wish that there was space to describe the manner in which Mr. Hornaday captured crocodiles with hook and line, and many other curious feats; but it is impossible. The book is finely illustrated with sketches, photographs, and a few other pictures. It further contains two moderately good maps, and but for its bulk would be a most welcome addition to the library.

ASTRONOMICAL NOTES.

First observation of Nova Andromedae. — The earliest observation of the new star, thus far reported, was by M. Gully, director of the public observatory at Rouen, on Aug. 17; and as M. Tempel, director of the observatory at Florence, affirms that it was not visible on the 15th and 16th, we are not likely to get much nearer the time of its first appearance. In *l'Astronomie* for November, which gives the above facts, M. Trouvelot also states that a 13 mag. star, which precedes the *nova* about 20^s and is a little south of it, and which is now visible with an 8-inch, is not put down upon a drawing of the nebula which he made in 1874 with the 15-inch of the Harvard college observatory, and that he does not think it could have escaped him if as bright then as now. It would seem as if this nebula were an object that should be watched pretty constantly, and of which a series of comparable photographs at stated intervals would be especially valuable.

Wire-gauze screens as photometers. — Of late years the use of wire-gauze screens, one or more in number, over objectives, has come into use for several purposes. Over one of the halves of a heliometer-objective they are used to reduce the image of a bright star to approximate equality with that of a fainter star from the other half, an essential condition for the most accurate superposition of the two images. With a meridian-circle they are used to reduce the brighter stars to an approximate equality with the faintest that can be observed with satisfactory precision, or to investigate the difference of personal-equation for different magnitudes by taking different tallies of transit-wires, with screen off and on, at the same

transit. In the latter case Professor Holden points out the necessity (*Astr. nachr.*, 2690) of changing the illumination of the field with the change of screen, so that each magnitude may show against its customary degree of color, or brilliancy of background. Such screens may also be used for photometric purposes when once their co-efficients of transmission have been determined. Those having occasion to use them in this way will do well to consult a paper by Professor Langley (*Amer. journ. sc.*, xxx. 210) on this subject. In this it is shown that the effective transmission co-efficients are decidedly different according as the luminous image is an extended surface, or practically a point like a star. In the latter case there is a central image surrounded by a system of diffraction images, into which a large part of the light goes; so much so, that Professor Langley found that a screen (of which one and two thicknesses transmitted .47 and .21 respectively of the full light upon a surface) gave only .18 and .02 for one and two thicknesses respectively, when measured by the brilliancy of the central image of a small pinhole as a source of light.

Comparison stars. — M. Folie, director of the observatory of Bruxelles, Belgium, announces that he also is ready (see *Science*, vi. 427) to determine the apparent places of comparison stars for comets and asteroids, if those desiring such determinations will communicate the approximate star-places to him.

Rhodope rediscovered. — On Oct. 3 Palisa found and observed (166) Rhodope, the search for which we before noted (*Science*, vi. 333) as the occasion of the discovery of (250).

The coast-survey system of longitudes. — In Appendix 11 to the coast-survey report for 1884, Assistant Schott rediscusses all the telegraphic longitude work thus far done by the survey, including the three transatlantic cable-determinations of 1866, 1870, and 1872. The whole work now includes 158 individual determinations of $\Delta\lambda$. Of these, 53 belong to a network covering 33 stations extending from Paris to Omaha, thus furnishing 21 rigorous conditions to be fulfilled by the longitudes of the 33 stations, a much stronger system than that discussed in the report for 1880. The average probable-error of single determination of $\Delta\lambda$, including every thing since the origin in 1846, comes out $0^s.038$, as determined *a priori* from the observations themselves, or only $0^s.016$ as the average since 1878, when improved methods were introduced. From the residual corrections, however, which result from the discussion, as necessary to make the 53 values of $\Delta\lambda$ satisfy the 21 rigorous conditions, the probable-error of a single $\Delta\lambda$ comes out $0^s.048$, indicating, as compared with $0^s.038$, that there are still some outstanding errors, probably of observers' personal-equation, which the *a priori* probable-errors do not cover. There is only one resulting correction to an observed value which reaches $0^s.1$, while in the latest adjusted system of European longitudes, which involves 59 measures with 26 conditions, although the average probable-error of a $\Delta\lambda$ comes out only $0^s.035$, yet there are six corrections to observed values which exceed $0^s.1$. It will be seen that the American work compares very favorably with the European, while it includes the three difficult transatlantic-cable links. Mr. Schott has accepted the decision of the Meridian conference, and in his final table prints longitudes east of Greenwich as +, and west as —. He has also gone through the tedious process of computing the probable-error of a function of adjusted values for the longitudes of Cambridge and Washington, which come out —

Cambridge, $\lambda = -4^h\ 44^m\ 30^s.993 \pm 0^s.041$,

Washington, $\lambda = -5^h\ 8^m\ 12^s.038 \pm 0^s.042$.

An interesting paragraph at the end shows that the rather remarkable agreement in the three transatlantic determinations of the longitude of the Harvard college observatory, as given in the report for 1874, was more an agreement of adjustment than of observation, and that the observed values have really a range of $0^s.13$. This is the most complete discussion of a network of longitude determinations yet made, and it well sustains the high reputation which the scientific work of the coast survey bears at home and abroad, very much of which is due to the thorough work of Assistant Schott and his efficient computing division.

NOTES AND NEWS.

WHAT is in some points a remarkable circular is prefixed to the current number of the *Zeitschrift für philosophie und philosophische kritik*, the most conservative and old-fashioned of periodicals. The management of the *zeitschrift* announces a new policy in view of the tendency of the best thought of the day, which is "to strive for a revival of the idealistic view of the universe, it being compelled thereto not less by practical than by scientific considerations." Therefore the polemical character of the *zeitschrift* will cease, the reason for it having been removed. In the second place, the vast amount of criticism will give way to explanatory sketches and sympathetic notices of new books and results, so that no investigation may have injustice done it at the hands of a reviewer of an opposite school. More attention is to be paid to the historical aspect of philosophy and the social sciences, and in especial will the work of countries other than Germany receive its share

of attention. This liberal programme is a cheering sign, and only shows that even the ultra-conservatism of this old-established journal has had to yield to the spirit of modern progress.

— Dr. Currier of New York has invented an apparatus by which the large class of deaf persons who have some small amount of latent hearing can learn to speak with greater uniformity and exactness. The difficulty is that the person affected hears only the voice of the teacher or the speaker through the tube, but does not hear his own tones. To accomplish this, a tube goes first from the mouth to the ear of the deaf person, and from there to the mouth or ear of the speaker.

— A stalactite cavern has been discovered in a hill called Kalksberg, near Wolmsdorf. The workmen were quarrying for marble, when they unexpectedly broke into the cavern, which they explored for about a mile and a half. In some places there were deep ponds, and an inner cavern was found that could only be entered by means of a ladder; they have only explored the cavern very imperfectly as yet.

— M. Duclaux, a disciple of M. Pasteur, has been studying the effect of sunlight on germs of parasitic life. For three years he has been watching tubes containing cultures of Tyrothrix scaber. This organism grows very well in milk, or in Liebig's infusion, by destroying albuminoid matter as pathogenic bacteria do. Drops of milk containing the organism were taken at the moment of spore formation, and enclosed in glass tubes plugged with cotton wool, so as to exclude external germs. The milk having been evaporated, some of the tubes containing the remaining spores were exposed to various degrees of sunlight for various periods, — a few days, a month, two months, a whole summer. Others were placed in a stove at a temperature equal to the maximum of tropical regions, in the dark or in diffused light. Eventually small quantities of milk were introduced into the tubes, so that the spores might be provided with the means of growth. None of the tubes subjected to warmth, but sheltered from the sun, have proved sterile, — a fact which shows that the spores of the microbe in question, even after being retained in a dry state and subjected to tropical heat for three years, do not lose their vitality if sheltered from the sun's light. Fifteen days' exposure to the light produces no observable effect, but after a month's exposure germination becomes obviously slower, while 50 per cent of the tubes exposed for two months have proved sterile. Spores subjected to sunlight proved much more feeble in Liebig's infusion than in milk; that is, a much larger proportion of the tubes remained sterile after a given exposure, if development in the former beverage was attempted, than if the latter was the medium of culture. Hence we must infer that not only is sunlight a powerful hygienic agent, but that much depends upon the character of the liquid to which a disease germ obtains access. M. Arloing has tried similar experiments with the formidable Bacillus anthracis, the organism associated with that malady so destructive to sheep, which, when transmitted to man, is known as the terrible wool-sorter's disease. He finds not only that sunlight has an attenuating influence, so that by its aid the germs can be converted into a vaccine, but that the influence can be transmitted and intensified through several generations. A spore born of a 'solarized' bacillus is more susceptible to the reforming influence than its parent was.

— The Henry Shaw school of botany, in Washington university, St. Louis, was opened on the 6th of November by an inaugural address given by the professor, Dr. Trelease, which has been printed. While the school bears the name of its founder, and will in due time take its full development in connection with the Missouri botanic garden at Tower Grove, the first professorship, as we are delighted to learn, commemorates in its title the late Dr. Engelmann. By this address the earnest and judicious young professor begins to open the eyes of the St. Louis people to the breadth, the interest, and both the educational and practical importance, of the subject which he is to teach.

— Felix Plateau has recently published (*Bull. soc. zool. France*) a series of interesting experiments on the palpi of insects, the results of which are quite opposed to the current idea that these oral appendages are essential both to the recognition and the seizure of food. He found that beetles, cockroaches, etc., may be deprived of either the labial or maxillary palpi, or both, and still retain the power of identifying and masticating their food. It is very curious that the function of such well-developed organs should so entirely elude us.

— The Congress of German anthropologists will meet at Stettin next summer. Prof. Hugo Lemcke, president of the City college, as chairman of the local board of managers, tenders an invitation to be present to all American students of anthropology desirous of attending the congress at Stettin, where they will meet Virchow, Schliemann, Schaffhausen, and others, and where their presence will be especially appreciated by the cordial hospitality of the Stettiners. Mr. E. Lemcke, of B. Westermann & Co., New York, will undertake to forward applications.

— Prof. W. D. Holmes, of the photographic laboratory, Lehigh university, offers a prize of fifty dollars for the best instantaneous shutter for out-door work presented before Feb. 1, 1886. Further information can be obtained of C. W. Canfield, 1321 Broadway, New York.

— The secretary of the treasury has appointed Mr. Artemas Martin of Erie, Penn., librarian of the coast and geodetic survey, having first consolidated the archives with the library. This will be gratifying news to the many readers of *Science* who have long held Artemas Martin in high esteem as a mathematician and a man.

— The December number of the *Botanical gazette* is to be a laboratory number, but will contain, in addition, a full description of the memorial vase presented to Dr. Gray, with illustrations of both sides.

— The fourth series of the 'Johns Hopkins university studies in historical and political science' (beginning in January, 1886) will be chiefly devoted to American city government, state constitutional history, and agrarian topics. Among the monthly monographs will be the following: Dutch village communities on the Hudson River, by Irving Elting; Rhode Island town governments, by William E. Foster; The Narragansett planters, by Edward Channing; Pennsylvania boroughs, by William P. Holcomb: Introduction to state constitutional history, by J. F. Jameson; City government of Baltimore, by John C. Rose; City government of Philadelphia, by Edwin P. Allinson; City government of Chicago, by F. H. Hodder; City government of St. Louis, by Marshall Snow; City government of San Francisco, by Bernard Moses; City government of New York.

— A unique institution is the Anthropological school of Paris. A good idea of its comprehensiveness is gained from its programme for the coming year. There are no less than six courses of lectures. M. Mathias Duval lectures on zoölogical anthropology, including comparative embryology and kindred topics. General anthropology is in the able hands of Dr. Paul Topinard, whose lectures will centre about the discussion of races and types. M. Manouvrier lectures on ethnology, giving special attention to normal and abnormal craniology. Medical geography, by which is understood the action of the environment, is the subject of a course by M. Bordier. The remaining courses are on Prehistoric anthropology, by M. Gabriel de Mortillet; and on the History of civilizations, by M. Letourneau. The lectures are held weekly, and, in addition, conferences are held from time to time. The course of lectures was begun on Nov. 9.

— Dr. Topinard has published a revised series of anthropometric instructions for travellers. The traveller, he says, need not trouble himself with questions of race, but should merely observe varieties of type. For this purpose he should take measures of as large a number of individuals as practicable, ten different measurements of one hundred individuals being more valuable than fifty of twenty-five persons. The measurements must be so simple as to reduce the personal equation as low as possible. They should also be so arranged as not to keep the subject in one attitude any longer than necessary. Men should be selected for measurement rather than women. All the instruments required may be collected into a small anthropometric box, the slide being the most useful. Dr. Topinard furnishes a form for recording results and remarks.

— M. Mercadier recently described before the Paris academy of sciences experiments undertaken in order to show that the elasticity of the metal diaphragms at the extremity of telephonic wires counts for nothing in the transmission of sonorous vibrations, or rather that it merely gives to the voice the nasal tone associated with telephonic conversation. M. Mercadier successively substituted for such diaphragms plates of greater and greater thickness, pieces of cardboard, and finally iron-filings. The intensity of the vibrations was diminished, but the tone of the voice became normal, and the most delicate inflections were transmitted with perfect exactitude.

BOSTON LETTER.

VISITORS to Boston many years ago were struck by the then novel sight of large labels attached to the stately trees on the Common, designating their scientific and common names and the country of their origin. This simple device for the instruction of the public was almost entirely the work of a single public-spirited man, the late Dr. A. A. Gould, the naturalist, whom more than one generation of Bostonians held in the highest esteem. Snatching the early hours from a laborious practice, he could be seen by early risers tacking his tins upon one tree after another for a whole season. After his death, I think it was, when these had grown dilapidated, some city forester, who, like many others since appointed, had no other than political claim to the place, instead of restoring, removed them. All efforts since made to renew the work have failed until now, when, thanks to the energy of a few interested persons, and the personal attention of Mr. John Robinson of Salem, the Common has again become a good botanical object-lesson.

The terrors of the ravages of white ants in tropical countries came vividly to mind a few years ago, when Dr. Hagen of Cambridge announced material damage to old documents in our State House to be the work of a native white ant. Similar destruction having already been reported in the archives of Springfield, Ill., the matter excited no little concern. There was no question of the damage done, though the state officials were somewhat relieved at finding it mainly concerned ancient tax papers of no other than historic interest, and was confined only to a single apartment. I mention it now only to state that it is to this room that the papers of the Board of health, lunacy, and charity have just been consigned, and that the recent discovery of two large timbers used in the construction of an old house on Beacon Hill, not far from the State House, so riddled by these insects as to render them unfit for further use, shows that the peril was not magnified by the learned entomologist.

One of the most successful efforts made here in recent years for public instruction in science has been carried on under the auspices of the Natural history society, and latterly through the assistance of a portion of the Lowell fund, which has so long supported the Lowell institute courses of lectures. It owes its origin mainly to the deep interest and financial aid of Mr. John Cummings, a vice-president of the Natural history society, and its steady growth to the personal attention of Professor Hyatt, the curator of the society. The Teachers' school of science, as it is called, inaugurated and maintained under these auspices, has now an assured existence, is thoroughly appreciated by the public-school teachers of the vicinity, and has received the warmest praise from the highest school authorities. It has just commenced its fourteenth year with a course of ten lectures, or, more properly speaking, object-lessons, on worms, insects, and vertebrates, by Professor Hyatt, which is to be followed by a mineralogical course given by Professor Crosby. This year Professor Hyatt has had prepared for his course, among other things, two or three hundred dissected kittens, the internal organs being preserved in place and in form by a species of tanning, which renders them as plastic as a kid glove, and permits their free and cleanly handling. In this way, parts which before could only be explained by diagrams, can now be examined by each member of a class, and their relations to all the surrounding parts seen and studied personally (each one is even allowed to retain a set of the objects used), — an advance which will be thoroughly appreciated by every promoter of object teaching. Admission to these lessons is free to teachers holding tickets, which are distributed on application to the public-school authorities; and the courses are so popular that the society's hall has long been outgrown, and the large Huntington hall of the neighboring Institute of technology has been brought into requisition.

Last week, Wednesday, the veteran botanist, Dr. Asa Gray, celebrated his seventy-fifth birthday. It was made memorable by the presentation to the learned and genial professor — still as active a worker as at forty — of an exquisite silver vase of charming proportions, "in token of the universal esteem of American botanists;" the vase itself being completely covered, above its fluted base, with a floral design, in which, in *repoussé* work, are exquisitely delineated choice flowers of the American flora named for Dr. Gray, or in other ways specially significant of his work, with others which have been his favorites. The idea was originated and carried out by the editors of the *Botanical gazette*, and was a complete surprise to Dr. Gray, who was profoundly moved by this pleasing proof of the general affectionate regard in which he is held by his collaborators. The presentation was entirely informal, and was made by Professor Barnes, one of the editors of the *Gazette*, temporarily residing in Cambridge, who placed it in Dr. Gray's hands, with the personal cards of the 180 botanists who contributed to the vase, many of them accompanied by a few words of congratulation, placed on a silver salver having the inscription: "Bearing the greetings of one hundred and eighty botanists of North America, to Asa Gray, on his seventy-fifth birthday." Among the many other remembrances he received was the following pleasing quatrain sent by Mr. James Russell Lowell: —

> "Just Fate, prolong his life, well spent,
> Whose indefatigable hours
> Have been as gayly innocent,
> And fragrant as his flowers!"

The week has also witnessed another event of personal and scientific interest. The dinner given to the designer of the Puritan by the scientific club of the city, to which reference was made in a former letter, came off last Friday, Mr. Burgess having consented to comply with the wishes of his friends. Although the club is a small one, numbering only about sixty members, who meet once a month for a dinner, generally to the number of from twelve to twenty, no less than forty gentlemen, including a few guests, sat down to the table, after which Mr. Burgess entered into a few interesting details concerning the construction of the Puritan.

Y.

Boston, Nov. 23.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The English sparrow.

THIS bird seems to be on trial for its life before the American people. The charges against it are so indefinitely and loosely stated, that a cautious judge would be obliged to rule out a very large part of them. The bird is charged with many misdemeanors — such as tyrannizing over our native birds, and driving them from our home grounds, gardens, etc., to our great loss and damage; to leaving the insects which they were imported to destroy largely unmolested; to robbing our grain-fields and storage-houses; to befouling our roofs, rain-gutters, pipes, and walls of buildings, to the entire destruction of our rain-water supplies, etc. Words of praise are few and far between. The fact is, it has got a bad name, and with the usual result, — every one is ready to cast a stone at it, whether he knows any thing against or for it.

Whether the object of its importation — the destruction of worms and insects in the city parks — was a success or failure, I know not. My impression from the general reports is, that it is largely, if not entirely, a failure.

The sparrow is an active, hardy, and persevering bird; it has already possession of the New England, the middle, and the western states to the Rocky Mountains, and perhaps of the southern. From 1870 to 1872 I saw them in possession of the towns of the Missouri River valley, from Kansas City, north to Omaha. Probably the lower valley to St. Louis was occupied before this, as St. Louis had been previously occupied. Whether they had progressed then north from Omaha, I do not know.

Mr. Ralph S. Tarr, in *Science* (vi. 416), says, "In the southern and western states, beyond the Mississippi River, the bird has not been observed." This is a mistake so far as the western states are concerned, and may be for the southern. I saw them also in 1873 in Lincoln, Nebraska, 55 miles west of the Missouri River, and in Denver, Col., in 1883.

They seem to follow the great thoroughfares of transportation, probably attracted by the scattered grains upon the roads. In 1876 I saw them on the Chicago and north-western railroad, in Iowa, moving westward; and in 1883 moving northward above St. Joseph, on the Kansas City, St. Joseph, and Council Bluffs railroad.

The bird seems to have a marked preference for cities and large towns, probably from the greater abundance of its favorite food, the grains scattered in the offal of the great thoroughfares and about grain warehouses. Exceedingly social and gregarious, it selects the eave trough-pipes, cornices, and angles of the higher and larger buildings of these thoroughfares, for its retreats, nests, etc. It seems to care but little for trees or shrubbery, the common resort of our native birds: hence they seldom come in collision. From 1869 to 1882, my residence at Plattsmouth, Nebraska, and grounds, were embowered with trees and shrubbery, and the grounds were the resort of large numbers of our native birds. The sparrows were thick upon the streets, but I never saw one inside of the grounds, or interfering with the native birds. Since 1882, at Kansas City, under like surroundings, the same results obtain.

As an insectivorous bird, I know nothing of them, but presume that when grain fails they may resort to insects. Have you not in the east, where the birds must now be much more numerous, and their habits more fully developed, many witnesses who can tell us what they know rather than what they do not know? The public would then be prepared to sit in judgment on the accused. Will not such witnesses give your readers this evidence through the columns of *Science?*

But now suppose this evidence adverse to the bird, and judgment of extermination follows. How is this sentence to be carried into execution? Shall it be by shooting? A survey of the field and a little consideration make this appeal a large undertaking; not unlike the extermination of the swarms of locusts which invade us — or even the flies and mosquitoes — by shooting. The idea is absurd. How will poison operate in the case? But a few moments' consideration will show the vast dimensions of this undertaking: first, the invention and preparation of a poison in such form as to induce the bird to prefer and take it in place of its own natural and accustomed food, if this can be done; then the millions of miles of area over which this preparation must be distributed to insure success, for by this time the bird must be assumed to be spread over the entire country, east and west, south and north, embracing Canada as well as the entire Pacific coast, involving the action of different governments.

Again, suppose this feat accomplished. What will be the effect of such a mass of poison on the entire life of the country, human as well as animal? And may we not stop here, and leave poison as among the absurd ideas?

The condemned sparrow seems to be entire master of the position; and can we not imagine it, in the slang phrase of the day, asking us, 'Well, what are you going to do about it?' A. L. CHILD, M.D.

Kansas City, Nov. 17.

Stepniak's 'Russia under the czars.'

In *Science*, No. 142, you reviewed Stepniak's 'Russia under the czars.' I wonder that the author's real name is not known to you. It is Krawtschinsky, the murderer of Mesentzof (1878). A person of that sort has, I think, no right to complain that his friends are kept in confinement, and prevented from committing new crimes. A lie is certainly a very little offence in comparison to what he did and advocates; and lies are freely resorted to by that author on the old plan, '*Calomniez, il en restora toujours quelque chose.*' Now, besides, such a kind of lie pays well in England as sensational, as well as answering to the hatred of a considerable number of the higher and middle classes in England. How freely lies must be indulged in is shown by the statement you reprint, that the fortress of Peter and Paul is known as the place from which Krapotkine escaped. Now, this is a lie. Krapotkine was able to escape only because, on account of his real or supposed illness, he was transferred to a hospital.

As to cruelties perpetrated in the fortress, nobody who is not blinded by party spirit believes in them here, and this on account of the fact that until recently (1880) the prisoners could freely exchange letters with their friends by the aid of bribed guards; so much so, that Nitchayef conducted from his prison a great deal of the nihilist plots. Any cruelty inflicted on prisoners would be known in that way, but there is none except solitary confinement.

A. WOEIKOF.

St. Petersburg, Nov. 7.

SCIENCE.—SUPPLEMENT.

FRIDAY, NOVEMBER 27, 1885.

A NEED FOR A CAREFUL STUDY OF THE HISTORY OF CHINA.

WHEN it is remembered that the Chinese writers have hardly any conception of history in our sense of the term, that their most renowned historians give us little more than annals or chronicles, the dead and fleshless bones of history, we cannot complain that Fries's history of China, which is a condensed translation of Chinese writers, is not a rich and flowing narrative. It is simply a bald outline of the succession of sovereigns and dynasties, of the tricks and vices by which the throne was often won, of the military achievements of the rulers, and of the divisions and reunions which the territory of the empire has undergone. Of the condition of the people through the long period of their national existence, of their progress in arts and learning, of the philosophy of their institutions, of the solution of the problem of their survival of all the destructive influences which have wrecked every other nation, we hear nothing in this book, because the Chinese chronicler has said nothing of all these to the translater and compiler.

It is greatly to be desired that some competent scholar should make a careful study of Chinese political history and institutions, in the spirit in which Sir Henry Maine has studied the institutions and laws of ancient and mediaeval Europe and of India. There is reason to hope that not a little light could be thrown by such study on certain European institutions and traditions. Why should not the careful investigation of Chinese feudalism, which had run its course, and perished centuries before feudalism sprang up in Europe, yield results most interesting to the student of European feudalism? Why should not the careful study of the village organization in China, which probably has scarcely changed for three thousand years, add to the light which Mr. Maine's study of the village communities in India has thrown upon the primitive life of Europe? Who that has observed the common responsibility of the dwellers in a Chinese street, for the preservation of order in that street, has not been reminded of the old Saxon frank-pledge? Is the resemblance accidental, or is there an historical basis for it? The day cannot be far distant when western scholars will be giving to such subjects the attention they deserve. A profound knowledge of the Chinese language, exhaustless patience in ransacking the voluminous literature of China, and a thorough investigation of existing usages and laws in towns and villages of China, will be necessary for the successful prosecution of such work. But the facilities for mastering the language are now so great, and the opportunities for coming into close contact with Chinese life and thought are so rapidly increasing, that the younger scholars need not despair of accomplishing what has hitherto been impossible, but what may prove a most valuable contribution to the history of institutions.

JAMES B. ANGELL.

Abriss der geschichte China's seit seiner entstehung. Nach chinesischen quellen übersetzt und bearbeitet von Sigmund Ritter von Fries. Wien, *Frick*, 1884.

PRODUCTIVENESS.

THERE are many problems of a biological nature which, when applied to man in particular, assume an economic aspect. The statistics of the birth and death rates, of the growth of populations, of the number of children per marriage, and so on, belong to the biologist as well as to the political economist. The interest of the former is a little broader, because similar statistics for other animal species would have considerable value for him, while the economist would hardly care to spend time on this side of the question. Owing to this close relation of these biological and economic questions, it sometimes happens that the latter tries to answer the question about which the biologist is the judge, or *vice versa*. The last French census has given the economists a chance to reproach France with the charge of sterility, implying as it does that the sterility is the result of voluntary determination. M. Gaetau Delaunay[1] denies the justness of this reproach, and holds that the decrease in productiveness observed in the French people is a biological fact which must be explained by an examination of the natural conditions which control the production of offspring.

The lower species of plants and animals are more fertile than the higher. The female of the white ant lays 60 eggs per minute; a queen bee deposits 5,000 to 6,000 eggs annually. In vertebrates, fecundity diminishes as we rise from fishes to reptiles, from reptiles to birds, from birds to

[1] *Revue scientifique*, Oct. 3, 10, 1885. The editor of the *Revue scientifique* records in a footnote the death of M. Delaunay just as these papers went to press.

mammals. In a general way there is an inverse relation between the number of offspring and the size of the animal. (This may indicate why many of the mammoths are extinct.) While the lower species is more productive, the life of the individual is much shorter. This inverse ratio between the productiveness of the species and the longevity of the individual is a very fortunate arrangement; for, according to the estimation of M. Quatrefages, two successive generations of the offspring of a single plant-louse would cover eight acres, and the fish would fill the sea in a man's lifetime. Again: in the lower organisms the mortality is great; very many die before reaching maturity.

Inferior races are more prolific than superior races. The finest varieties of fruits bear least. Dog-fanciers testify that the most intelligent varieties have the fewest young ones. In man the lower races[1] are most productive. Among the Kafirs twins are said to be as common as single births, and triplets frequently occur. The black race is more fertile than the white. One authority gives 2.05 children for each white woman, and 2.42 for the colored. The Chinese occupy less than 1-300 of the surface of the globe, and yet their population includes nearly 1-3 of the human race. Among European nations, Russia and Spain are the most productive, Switzerland and France the least.

The inference to be drawn is not that in France the duties of maternity are shirked, but that the natural effect of a high civilization shows itself in this diminution of fertility. Nor is it a mark of decadence, for the Swiss nation shows a similar phenomenon. Again: while Spain and Italy show a higher productiveness, the longevity is lower. The average life is thirty-one years: in France it is forty years. France has more persons from fifty to sixty years of age than other countries. What is lost in quantity is gained in quality. The number of children per marriage has been declining: from 1800 to 1815 it was 3.9; 1815 to 1830, 3.73; 1874 to 1878, 3.04; but the mean life has increased. From 1810 to 1815 it was 31 years 3 months; 1820 to 1830, 32 years 2 months; 1861 to 1865, 37 years 6 months. In other countries of advanced civilization, the fertility, though still high, is on the decrease. England, Austria, Prussia, — all show the same state of affairs. These countries will in time exhibit the same loss of fecundity as is shown in France now. An additional refutation of the charge of the voluntary origin of this sterility is the fact that the ratio of marriages to the population has not been decreasing in France, and is now as high as elsewhere.

The young are more fertile than the old. Young vines give a large harvest, but the grapes are poor. Buffon states that at 18 women are more productive than at 30; according to an English authority, fertility increases up to 25 or 30 years, and then diminishes. To-day the French woman is 24½ years old, the man 29 years 7 months, at the time of marriage. In the eighteenth century they were 19 and 25 years respectively. The result is that to-day the fertility is less; but the quality of the offspring is better.

Within certain limits a weak temperament favors fertility. Domesticated animals have more offspring than wild ones. A vigorous active life apparently does not favor longevity. Tailors and shoemakers have more children than blacksmiths. The ancient athletes and the modern acrobats seldom have children. War kills off the strongest men, and leaves the weak to propagate the race; hence the birth-rate increases. From 1811 to 1815 it was 3.49, but from 1816 to 1820 it was 4.08 in France.

Brain-workers and intelligent people have fewer children than others. Sixty-one married professors of the medical faculties of Paris, Lyons, and Bordeaux, had only 1.78 children to each marriage. The mortality among these children, however, was very low; and so, in general, the offspring of these more evolved, less fertile classes is of a stronger, larger, and higher kind. *Fortes creantur a fortibus.*

There probably is a limit below which propagation is impossible; but there is surely a limit of too high nurture, above which reproduction is lowered; and the maximum fecundity is a state nearer to the want than to the excess of good nurture.

In the more advanced races a famine increases the birth-rate. The poor are notoriously prolific of offspring. But the offspring of the wealthy classes is longer lived. Finally, as to climate: the fertility is higher in warm countries, but the mortality is lower in the north than in the south.

Productiveness is a characteristic of the lower species and races; of the younger individuals; of the weak, both bodily and mentally. There is throughout an inverse relation between quality and quantity of offspring. All circumstances that modify fecundity in plants and animals are equally active in man, and hence in the French people as well. The diminution in fertility observable in other European nations as well as in the French is a physiological and not an economic

[1] The Hottentots, Fuegians, etc., are really no exceptions, as these races are starved, and naturally tend to extinction.

fact: it is determined by natural conditions, and not by the voluntary decision of individuals.

J. J.

A SUGGESTION FROM MODERN EMBRYOLOGY.

ONE of the obstacles which proved to be a difficulty of considerable weight to Darwin in his application of the descent theory was the sudden appearance of a highly developed fauna in the Silurian age. This difficulty has not decreased, but has rather increased with the further knowledge of that fauna. The primordial fauna, as shown by the fossils of the Silurian rocks, was not what naturalists would have assumed had they been called upon to construct this fauna from *a priori* grounds. Instead of a few simple generalized forms, these early rocks showed evidence of a highly diversified fauna. In the Silurian rocks are represented all of the great divisions of the animal kingdom, including even the vertebrates. Moreover, of the smaller divisions, a sufficient number are here represented to cause considerable surprise. About five-sixths of the orders now existing, nearly an equal proportion of sub-orders, a great many families and some genera of to-day are found in these earliest rocks. It is indeed remarkable to find such a very large number of existing groups represented in the earliest fauna of which we have any knowledge. It is true that the Silurian age lasted a long time, and that in the lower Silurian the fauna is not quite so diverse as above indicated; but even here it is sufficiently diverse to be surprising. When the history of vertebrates since that time is compared with the history of other groups, the contrast is very striking. They have had time enough to develop from the very lowest forms — which we judge lived in the Silurian times — into the present highly diversified groups. But with all other groups of animals the advance has been comparatively small. It must be assumed, to reconcile these facts with evolution, that enough time elapsed between the beginning of life on the world and the beginning of the Silurian to develop all of the sub-kingdoms except the vertebrates to a high degree of differentiation. And, when the great amount of time which it has required to develop the vertebrates is taken into consideration, the amount of lost time necessary to assume previous to the Silurian seems too great to be credible.

It will, of course, never be possible to reconcile the Silurian fauna with evolution without the assumption of a long lost period of this character. But certain general results from modern embryology are in this connection suggestive, and indicate that the difficulty is not so great as has been sometimes conceived. For modern embryology is teaching us that our various sub-kingdoms are all direct modifications of the most primitive multicellular animal. Using embryology as a guide in interpreting animal history, naturalists have been continually shortening this history, particularly at the bottom. From the time when Haeckel traced the genealogy of man through twenty-one stages, these stages have one by one been dropped by naturalists, with the result of making the history a much more direct one. Finally, the recent theories of Sedgwick, and others who follow him wholly or partially, would make the history of all animals much shorter by showing that all the sub-kingdoms may be regarded as resulting directly from modifications of the gastrula by slight changes in its shape. We once derived the worms from the coelenterates, the annelids from the lower worms, and the vertebrates from the annelids; but now all of these groups are derived directly from the gastrula itself. This theory of Sedgwick is receiving support in some form from many sources — at least, so far as concerns this feature of it. There is certainly a tendency to-day to look upon a greater and greater number of types as direct modifications of the original animal represented by the gastrula stage. Coelenterates, polyzoa, brachiopods, mollusks, annelids, and vertebrates have all been shown to be derivable from the gastrula by simple direct modifications.

Now, we must remember that slight variations at the bottom of a diverging series produce much greater effects than variations higher up. When a tree is first sprouting, differences in the direction of its buds determine the shape of the future tree; for these early buds become the great branches, and the slightest difference in their direction is enough to cause a wide separation between them as growth goes on. After the tree has grown to a considerable size, its buds no longer produce great branches, but only small ones, or perhaps only twigs. Growth cannot now change the general shape of the tree, but only increase the profusion of small branches, twigs, and leaves. That such a relation represents the history of the various groups of the animal kingdom is unquestionably the teaching of modern embryology.

The significance of this result in enabling us to understand the fauna of the Silurian rocks is evident enough. It not only shortens the time necessary to be assumed prior to the Silurian, but it also enables us, partially at least, to understand the presence at this early period of such a large number of our present existing types. For the protozoan to develop into the first multicellular animal, represented by the gastrula, must have

taken a length of time of which we have no means of getting an idea. But after this animal was developed, the origins of the various great types were not serial, but simultaneous. This animal began to be modified in various directions to fit its surroundings, and the result was a rapid divergence of groups. Slight variations in these simple types would cause the descendants of the various lines to separate still further. We can therefore imagine the Silurian times to be somewhat close to the origin of life, and yet not be surprised at the existence of all the greater divisions of the animal kingdom, and many of the smaller ones. We can also understand why it is that the development of most groups since that time has resulted chiefly in the increase of the abundance and diversity of small branches. For the Gastrea, having diverged into several great branches, has itself disappeared as such, and can of course produce no new sub-kingdoms. Development must now take place within the branches, and must confine itself to smaller and smaller particulars as evolution progresses. Modern embryology, therefore, showing as it does the early divergence of the great types, offers to us an explanation both for the highly diversified fauna of the Silurian age, and for the comparatively less importance of the development that has taken place since that time, even though post-Silurian times be recognized as very much longer than pre-Silurian times. And we are finally led to believe that the vertebrates also were much more abundantly represented in this fauna than the scanty remains hitherto discovered would indicate.

H. W. CONN.
Wesleyan university, Middletown, Conn.

POLITICAL SCIENCE IN FRANCE.

As M. Donnat well remarks, politics in France have been largely based on sentiment and abstract reasoning rather than on the lessons derived from observation. Frenchmen are confessedly adepts in constitution-building, but so little acquainted are they with the practical history of political methods that they have not yet arrived at the stage of regarding politics as an art, much less as a science. It is well, therefore, to notice these two works[1] as written in the spirit of comparative politics. M. Donnat maintains that there is a science of politics whose principles are as unvarying and determinate as the laws of the natural and physical sciences. A political solution may be compared to the product of the two gases in fixed volumes to form the molecule of water; nor is there any higher power to introduce uncertainty in the operations of political forces. This is no new thought; and if the English reader wishes to understand the significance of such political inquiry, free, however, from the particular irreligious character of M. Donnat's thinking, he is already in possession of the suggestive work by Sheldon Amos on 'The science of politics.' While the latter has the advantage in philosophic treatment of the subject, the former is more imperative in his claims for the purely scientific nature of politics. He is constantly suggesting parallel illustrations from the other sciences, and derives much comfort from a contemplation of the methods employed by Claude Bernard in his development of the science of medicine. M. Donnat's spirit of inquiry, nevertheless, is admirable, and one sure to be fruitful in its results. He is animated by the spirit which prompted De Tocqueville, Comte, and Le Ploy. Like the first, he has travelled much abroad; and his knowledge of English and American political life extends even to the details of such legislation as our homestead laws. In early life he hoped to find in Comte a guide, but this master soon turned aside, and became a divinity. In Le Ploy, also, he well-nigh found a kindred spirit; but, instead of persisting in those remarkable studies of the civic and industrial institutions of European society, this profound thinker also was drawn into immature synthesis, in declaring that religion was indispensable for private and public life. With M. Donnat it is ever observation and experimentation in politics. The former, on account of the complexity of political phenomena and political Daltonism on the part of the observer, is insufficient. It must be supplemented with experiment. The great success of the Swiss, English, and Americans has been due to their adoption of this principle. Their legislation is not only of local application, but limited in time; and the different legislative assemblies of England's colonies are compared to so many political laboratories. In France, however, legislation is indiscriminating. The colonies have no local voice. An enactment of the Palais-Bourbon is as far-reaching in its provisions as the limits of the most distant colonial possessions. Nor is legislation of that tentative character which should be the spirit of all genuine scientific inquiry. The author, therefore, earnestly pleads that France cut loose from its hard and fast methods, and make trial of local and temporary legislation.

M. Guyot is even savage in his criticisms. The arraignment of French colonial policy is exhaustive in its details. The budgets and commercial statistics of colony after colony are taken up and

[1] *La politique experimentale.* Par LEON DONNAT. Paris, *Reinwald*, 1885.

Lettres sur la politique coloniale. By YVES GUYOT. Paris, *Reinwald*, 1885.

skilfully analyzed to prove that no Europeans, except possibly Spaniards or Portuguese, can be acclimated in the zone lying between the isotherms twenty-five degrees north and south of the equator. Of the French colonies, Algiers and New Caledonia are the only ones not situated within these limits. From every point of view, the French colonial policy is shown to be disastrous. Neither the French race or language can thus hope for expansion. Even commercially it is a failure, for foreign nations can undersell France in her own colonies. French emigration is always fatal when it is perpendicular instead of parallel; and there can be no national advance until an intensive colonial culture be substituted for the extensive system so popular in this day. The work has many interesting points for the ethnologist to consider, such as the relations of European colonists with indigenous races. It is written with much force and even grim humor, as when the author, after analyzing the statistical situation of Algiers, sums it up with the picture of the twenty-five thousand productive colonists, each seated on four graves, and guarded by a brace of soldiers.

These two books are suggestive not only for their political philosophy of freedom, but also as furnishing clear and forcible views of the difficulties which stand in the way of French progress.

STARS IN RAPID MOTION.

THE small value of the parallax of 40 o^2 Eridani (*Science*, vi. 358), combined with its large proper-motion (4″.10), brings it into prominence as the third or fourth of the stars, moving rapidly across our line of sight. Since a list of these stars seldom appears in works on popular astronomy, we give below the proper-motions μ, the parallaxes π, and the resulting velocities v, in miles per second across our line of sight, of the eight stars which head the list in the order of velocities. The method of deriving the velocities is of course very simple. If a star's annual proper-motion equals its parallax, it moves across our line of sight each year a distance equal to the semi-major axis of the earth's orbit. (How much it moves to or from us can only be told by the spectroscope.) Therefore, since this motion increases directly as μ, and inversely as π, we have for the annual motion across the line of sight —

$$v\,t = a\,\frac{\mu}{\pi},$$

or, calling a 92.5 million miles, and t the number of seconds in a year, we have for the velocity in miles per second —

$$v = 2.93\,\frac{\mu}{\pi}.$$

Of course, the proper-motions below are much more accurately known than the parallaxes, and where the latter are small the values of v are correspondingly uncertain. The authorities for the adopted values of π are given in the column following them. In the case of 40 o^2 Eridani, we have weighted Gill and Hall 2 and 1 respectively, as the former determination was made under much the more favorable conditions, and rests upon two comparison-stars. The latest values of Hall and Ball for 61 Cygni are practically identical. The probable errors of all the values of π are generally less than 0″.02.

Star's name.	μ	Parallax.		v
		π	Authority.	
Groombridge 1830....	7″.05	0″.09	Brünnow	230
Lacaille 9352.....	6 .96	0 .285	Gill.....	71
40 o^2 Eridani	4 .10	0 .185	Gill and Hall.....	65
e Eridani	3 .10	0 .14	Elkin.....	65
ϵ Indi.....	4 .68	0 .22	Gill and Elkin.....	62
Lalande 21258.....	4 .40	0 .27	Auwers.....	43
61 Cygni	5 .23	0 .48	Hall and Ball	28
Lalande 21185.....	4 .75	0 .50	Winnecke.....	28

The first will be recognized as Newcomb's 'runaway star,' so graphically described in his 'Popular astronomy;' but it will be seen that the others have velocities which are at least comparable with that of Groombridge 1830, and indicate momenta that represent vast amounts of energy. The discovery of huge suns like our own rushing through space with these great velocities is a matter of more than usual interest just now, from the fact that Mr. Denning's claimed discovery of fixed meteor-radiants has raised the question as to the possible existence of broad swiftly flying streams of meteorites in inter-stellar space, moving with velocities entirely beyond the control of our sun, and so broad that it takes the solar system some years to pass through them. (An annual parallax of 1° in a meteor-radiant corresponds to a velocity of over 1,000 miles per second for the meteor-stream.) The idea of such streams moving with such velocities is a startling one, and, if shown to be true, gives a very vivid idea of the forces acting, or which have acted, in stellar space. It seems at first highly improbable that such can be the case, but with the hard facts of Groombridge 1830, and these other swiftly flying suns staring us in the face, the idea is worth considering, at any rate. If these suns are the products of condensation due to central attraction, so that the luminous energy by which they reveal themselves to us was once energy of translation, it is no violent assumption to suppose that some of their constituent parts were once moving with much greater velocities than that of the present whole. In fact, the man who should claim as a

possibility that space contains broad belts of small particles moving with velocities which are the resultant of all the forces acting on them since primeval chaos, and which have not yet been gathered into the control of any one of the stellar systems among which they are sweeping, would find much to confirm his ideas in these giant swiftly flying suns. The question is certainly of sufficient interest and importance to call for a thorough overhauling of the present methods of determining meteor-radiants, for probably most astronomers would to-day be disposed to deny *in toto* the existence of the greater part of these so-called radiant-points. H. M. PAUL.

ALPINE CRETINISM.

CRETINISM is a peculiar form of idiocy which Dr. Kratter defines as "an arrest of psychical development, associated with very manifest malformations of the body, and especially of the skeleton." Goitre is frequently, though not invariably, present. Rachitic deformities, deafness and mutism, and that peculiar disease myxoedema, combine with idiocy to characterize the cretin. The cause of cretinism has never been satisfactorily determined. Operations upon human beings for the removal of goitre have shown that cretinism will occasionally follow the extirpation of the thyroid glands, and therefore the disease would seem to be connected, in some measure, with the function of those glands. Moreover, in places where cretins are numerous, goitre is also prevalent, even to a greater degree.

It is a fixed belief among the laity that goitre and cretinism are developed through the drinking-water, and in some places particular wells are designated as being especially endowed in this direction. Such wells are even sought out and used by those who wish to develop goitre, in order to escape military conscription. The noxious element in such waters has been claimed by some to be an excess of chalk, while others say that too much magnesia is the baneful ingredient.

In order to contrast, within a limited area, the frequency of cretinism with the geological formation of the land, Dr. Kratter has carefully studied a district in the Austrian central Alps, where cretinism is so frequent that it amounts to an actual scourge.

In Tyrol there are 112 cretins to every 100,000 of population. Salzburg presents 309, Kärnten 343, and Steiermark 240, cretins for every 100,000. In Muran one per cent of the entire population is tainted with this disease. When we remember, he remarks, that the officially recorded cretins are not nearly the entire number, and that between the healthy people and the fully developed cretins there must exist a broad zone of partially feeble-minded folk; and, still further, when it is known that in the same communities pure goitre is five to ten times more frequent than cretinism, — we have a picture of endemic affliction which may well be called a scourge.

Kratter found that the maximum frequency of goitre followed the gneiss and granite formations which are rich in magnesia, while, on the other hand, the disease was extremely rare over chalky areas. The people in the regions noted were of the same nationality, and exhibited the same habits and customs. Elevation also appears to have a marked influence upon the frequency of cretinism. Cases are not developed higher than 1,000 metres above the sea, and they are extremely rare below 300 metres elevation. The greatest frequency occurs in mountain valleys which are between 400 and 700 metres above sea-level. Many villages in such valleys present the high proportions mentioned above.

Dr. Kratter gives his short paper simply as a summary of his work thus far, but he does not attempt to draw ultimate conclusions from it, because the field in which he labored was limited. He hopes that government interest may be attracted to this disease, and that a wide-spread and systematic investigation of the subject may be undertaken.

Der alpine cretinismus insbesondere in Steiermark. Von Dr. JULIUS KRATTER. Graz, *Leuschner & Lubensky*, 1884.

AT a recent meeting of the Paris academy of medicine, M. Roullier, a surgeon attached to the French navy, gave an account of the practice of transfusion of blood in cholera cases at the St. Mandrier hospital, Toulon. The operations were performed during the state of collapse. Of 55 cases, 18 recovered. The transfusion of 1,500 to 2,000 grams 'literally effected a resurrection;' but, unfortunately, in the majority of cases the patients did not permanently recover.

— A manufacturer of Breslau is stated to have built a chimney over fifty feet in height entirely of paper. The blocks used in its construction, instead of being of brick or stone, were made of compressed paper, jointed with silicious cement. The chimney is said to be very elastic, and also fireproof. We may add that picture-frames are now made of paper. Paper-pulp, glue, linseed oil, and carbonate of lime, or whiting, are mixed together, and heated into a thick cream, which, on being allowed to cool, is run into moulds and hardened. The frames are then gilded or bronzed in the usual way.